

REMARKS

This is intended as a full and complete response to the Office Action dated April 14, 2005, having a shortened statutory period for response set to expire on July 14, 2005. Please reconsider the claims pending in the application for reasons discussed below.

Claims 1-20 remain pending in the application and are shown above. Claims 1-6 and 8-20 are rejected by the Examiner. Claim 7 is objected to. Reconsideration of the rejected claims is requested for reasons presented below.

Applicants have amended paragraphs [0033], [0076], [0078], [0081], and [0083] in the specification to correct typographical errors. Applicants submit that the changes made herein do not introduce new matter.

Claims 1, 8, 11, 16, and 17 are amended to clarify the invention. Claims 6, 7, 10, 15, and 20 are amended as to matters of form. Applicants submit that the changes made herein do not introduce new matter.

Claim 7 is objected to under 37 C.F.R. 1.75(c), as being of improper dependent form for failing to further limit the subject matter of previous claims. Applicants have amended claim 7 to depend on claim 6. Applicants respectfully request withdrawal of the objection to claim 7.

Claim 1-20 stand rejected under 35 U.S.C. 112, second paragraph. The Examiner has objected to the phrase "low dielectric constant." Applicants have amended independent claims 1, 11, and 17 to delete or replace the phrase "low dielectric constant film" with "dielectric film comprising Si, O, and C." Applicants respectfully request withdrawal of the rejection of claims 1-20.

Claims 1-20 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 5, 7, 10-13, 16-26, and 29-30 of co-pending Application No. 10/302,393. Applicants are submitting a terminal disclaimer in a separate paper.

Claims 1-8 and 17-18 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-3, 17, 18, and 20 or 1, 2, 4-5, 14, 16, 20-24, 26-31, 33, and 36 of co-pending Application

No. 10/302,375 or 10/428,374, respectively. Applicants are submitting a terminal disclaimer for Application No. 10/428,374 in a separate paper.

Applicants respectfully traverse the provisional double patenting rejection over claims 1-3, 17, 18, and 20 of Application No. 10/302,375. While claim 18 of Application No. 10/302,375 recites 1,1,3,3-tetramethylbutylbenzene, Applicants respectfully submit that 1,1,3,3-tetramethylbutylbenzene is not a hydrocarbon compound comprising one ring and one or two carbon-carbon double bonds in the ring. 1,1,3,3-tetramethylbutylbenzene includes the aromatic group benzene, which does not contain double bonds. Applicants respectfully request withdrawal of the provisional obviousness-type double patenting rejection over Application No. 10/302,375.

Claims 1-6 and 8 stand rejected under 35 U.S.C. § 102(e) as being anticipated by *Grill, et al.* (U.S. Patent No. 6,312,793). Applicants respectfully traverse the rejection.

The Examiner notes that *Grill, et al.* describes a precursor mixture that may have cyclic hydrocarbons, such as cyclohexane, norbornadiene (*i.e.*, bicycloheptadiene) or aromatics, such as benzene or xylene. Applicants respectfully submit that *Grill, et al.*'s broad disclosure of cyclic hydrocarbons does not teach or suggest an oxygen-free hydrocarbon compound comprising one ring and one or two carbon-carbon double bonds in the ring. *Grill, et al.* teaches that multicyclic hydrocarbons are preferred (column 3, lines 38-47). Applicants respectfully submit that multicyclic hydrocarbons comprise at least two rings and thus do not comprise one ring. Applicants note that the few hydrocarbons named by *Grill, et al.* that comprise one ring, *i.e.*, cyclopentane and cyclohexane, benzene, toluene, and xylene, do not contain double bonds. As discussed above, aromatic compounds do not contain double bonds.

Thus, *Grill, et al.* does not teach, show, or suggest a method for depositing a dielectric film, comprising delivering a gas mixture comprising one or more linear, oxygen-free organosilicon compounds, one or more oxygen-free hydrocarbon compounds comprising one ring and one or two carbon-carbon double bonds in the ring, and one or more oxidizing gases comprising oxygen (O₂) to a substrate surface at deposition conditions sufficient to deposit a dielectric film comprising Si, O, and C on the

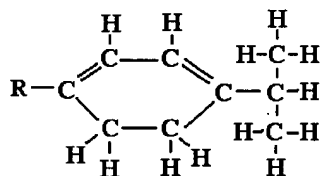
substrate surface, as recited in claim 1. Applicants respectfully request withdrawal of the rejection of claim 1 and of claims 2-6 and 8, which depend thereon.

Claims 9-15 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Grill, et al.* in view of *Wakizaka, et al.* (U.S. Patent No. 6,270,900). The Examiner acknowledges that *Grill, et al.* does not disclose alpha-terpinene or the hydrocarbon structure of claim 11. The Examiner asserts that it would have been obvious to use the cycloalkene compounds of *Wakizaka, et al.* in the process of *Grill, et al.* and that the cycloalkene compounds of *Wakizaka, et al.* would have been expected to be effective in *Grill, et al.*'s process since they have been shown to have analogous ring opening behavior or chemistry. Applicants respectfully traverse the rejection.

Wakizaka, et al. describes films of polymers for use with wiring boards, such as wiring films for semiconductor packages. *Wakizaka, et al.* states that the films may be formed from a polymer derived from ring-opening or addition polymerization of a monomer having a ring structure, and describes cycloalkenes such as 1,3-cyclohexadiene as monomers that can be used. *Grill, et al.* describes porous, multiphase low dielectric constant films comprising a first phase of SiCOH and a second phase of C and H dispersed in a host matrix of the first phase. Applicants submit that there is no motivation or suggestion in *Wakizaka, et al.* or *Grill, et al.*, individually or in combination, to use the hydrocarbon compounds that *Wakizaka, et al.* provides for polymer-based films to form the substantially different, multiphase film of *Grill, et al.*

Thus, *Grill, et al.* in view of *Wakizaka, et al.* does not teach, show, or suggest a method for depositing a dielectric film, comprising delivering a gas mixture comprising one or more linear, oxygen-free organosilicon compounds, one or more oxygen-free hydrocarbon compounds comprising one ring and one or two carbon-carbon double bonds in the ring, and one or more oxidizing gases comprising oxygen (O₂) to a substrate surface at deposition conditions sufficient to deposit a dielectric film comprising Si, O, and C on the substrate surface, wherein the one or more linear, oxygen-free organosilicon compounds comprises trimethylsilane and the one or more oxygen-free hydrocarbon compounds comprises alpha-terpinene, as recited in claim 9. Applicants respectfully request withdrawal of the rejection of claim 9 and of claim 10, which depends thereon.

Grill, et al. in view of *Wakizaka, et al.* does not teach, show, or suggest a method for depositing a dielectric film, comprising delivering a gas mixture comprising one or more linear, oxygen-free organosilicon compounds, one or more oxygen-free hydrocarbon compounds including the structure



wherein R is selected from the group consisting of linear alkane groups having one to five carbons, and one or more oxidizing gases comprising oxygen (O₂) to a substrate surface at deposition conditions sufficient to deposit a dielectric film comprising Si, O, and C on the substrate surface, as recited in claim 11. Applicants respectfully request withdrawal of the rejection of claim 11 and of claims 12-15, which depend thereon.

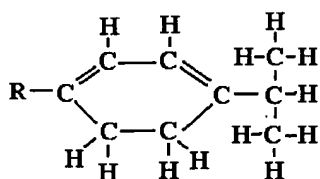
Claims 17-18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Grill, et al.* in view of *Goo, et al.* (U.S. Patent No. 6,057,251) or *Ross* (U.S. Patent No. 6,271,146). Claims 16 and 19-20 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Grill, et al.*, in view of *Wakizaka, et al.* and further in view of *Goo, et al.* or *Ross*. The Examiner asserts that it would have been obvious to employ the electron beam post-treatment of *Goo, et al.* or *Ross* instead of a thermal post-treatment in the process of *Grill, et al.* to obtain the advantages that electron beam post-treatment has been shown to provide analogous films. Applicants respectfully traverse the rejection.

Grill, et al. describes a method of depositing a multiphase low dielectric constant film, wherein the first phase is a host matrix of SiCOH, the second phase consists essentially of C and H atoms, and the film further includes pores (column 5, lines 56-65). *Grill, et al.* teaches that the film may be heated treated to reduce the dielectric constant and decrease the film density (column 6, lines 5-16). *Goo, et al.* describes electron beam treating a CVD oxide layer to densify the layer (abstract). *Ross* describes electron beam treating a fluorinated silicate glass film to reduce the moisture and hydrogen level in the film. *Ross* further teaches that the electron beam treatment

densifies the film (column 2, lines 37-43). Applicants submit that there is no suggestion or motivation in *Grill, et al.*, *Wakizaka, et al.*, *Goo, et al.*, or *Ross*, individually or in combination, to replace the thermal post-treatment of *Grill, et al.* that reduces film density with the electron beam treatment that *Goo, et al.* and *Ross* provide to increase film density. Applicants further submit that *Grill, et al.*, *Wakizaka, et al.*, *Goo, et al.*, or *Ross*, individually or in combination, do not provide a reasonable expectation of success that the electron beam treatment of *Goo, et al.*, or *Ross* could be performed on the porous, multiphase dielectric film of *Grill, et al.* without substantially modifying, e.g., densifying, *Grill, et al.*'s porous, multiphase film.

Thus, neither *Grill, et al.* in view of *Goo, et al.* or *Ross* nor *Grill, et al.* in view of *Wakizaka, et al.* and further in view of *Goo, et al.* or *Ross* teach, show, or suggest a method for depositing a dielectric film, comprising delivering a gas mixture comprising one or more linear, oxygen-free organosilicon compounds, one or more oxygen-free hydrocarbon compounds comprising one ring and one or two carbon-carbon double bonds in the ring, and one or more oxidizing gases comprising oxygen (O₂) to a substrate surface at deposition conditions sufficient to deposit a dielectric film comprising Si, O, and C on the substrate surface, and treating the dielectric film with an electron beam, as recited in claim 17. Applicants respectfully request withdrawal of the rejection of claim 17 and of claims 18-20, which depend thereon.

Furthermore, *Grill, et al.* in view of *Wakizaka, et al.* and further in view of *Goo, et al.* or *Ross* does not teach, show, or suggest a method for depositing a dielectric film, comprising delivering a gas mixture comprising one or more linear, oxygen-free organosilicon compounds, one or more oxygen-free hydrocarbon compounds including the structure



wherein R is selected from the group consisting of linear alkane groups having one to five carbons, and one or more oxidizing gases comprising oxygen (O₂) to a substrate

surface at deposition conditions sufficient to deposit a dielectric film comprising Si, O, and C on the substrate surface, and treating the low dielectric constant film with an electron beam, as recited in claim 16. Applicants respectfully request withdrawal of the rejection of claim 16.

Regarding claim 20, the Examiner asserts that while *Grill, et al.* does not disclose the specific combination of O₂ and CO₂, it would have been obvious to use CO₂ as a carrier gas in *Grill, et al.*'s process with O₂ as an oxidizing gas, as CO₂ is sometimes used as an inert gas and would be expected to act as an inert, non-contaminating gas in *Grill, et al.*'s process. Applicants respectfully submit that the Examiner's assertion that CO₂ could be used as the carrier gas in *Grill, et al.* does not provide a showing of a teaching or suggestion in *Grill, et al.* of a gas mixture comprising O₂ and CO₂. Applicants respectfully request withdrawal of the rejection of claim 20.

Claims 1-6 and 8 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-2, 5, 6, 8, 10-12, 14, 20, and 22-23 of U.S. Patent No. 6,797,643. The Examiner states that the claims of U.S. Patent No. 6,797,643 may comprise all the claimed gases and asserts that tetramethylbutylbenzene reads on the claimed hydrocarbon. The Examiner further states that the broader present claims encompass the narrower claims of U.S. Patent No. 6,797,643. Applicants respectfully traverse the rejection.

The claims in the instant application recite a gas mixture comprising an oxygen-free hydrocarbon compound including a ring having one or two carbon-carbon double bonds. As discussed above, aromatic compounds such as tetramethylbutylbenzene do not include a ring having one or two carbon-carbon double bonds. Applicants respectfully submit that as the claims of U.S. Patent No. 6,797,643 do not require an oxygen-free hydrocarbon compound including a ring having one or two carbon-carbon double bonds, the claims of the instant application do not encompass the claims of U.S. Patent No. 6,797,643. Applicants respectfully request withdrawal of the rejection of claims 1-6 and 8.

In conclusion, the references cited by the Examiner, alone or in combination, do not teach, show, or suggest the invention as claimed.

The secondary references made of record are noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, Applicants believe that a detailed discussion of the secondary references is not necessary for a full and complete response to this office action.

Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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